NEUGEN
& Data/MC Comparison

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Motivation

- ## See discrepancies between the Monte Carlo and the data
  - Described in previous talk (Structure Functions)
    - *Ave muon momentum lower in data than MC*
    - *Ave $\theta_{\mu\nu}$ lower in data than MC for both CCmu and CCe*
- ## Due to MC generator?
  - Our standard MC uses Lepto structure function 9 = CTEQ2L
    - $Q^2 > 1$ GeV^2, $W^2 > 4$ GeV^2
- ## Lepto & GEANT do not simulate intra-nuclear re-interactions
  - Negligible effect on lepton variables
- ## Lepto does not simulate quasi-elastic interactions
  - Expect QE contribution to be ~5%

NEUGEN

- Includes QE and resonance production
- Includes fermi motion and nuclear re-interaction
- Includes charm production
- Uses GRV-HO as standard ($Q^2 > 0.4$ GeV^2) via PDFLIB
- Low energy hadronization model

- Acquired code from Hugh Gallagher and incorporated into E872 MC
- Generated 10k events (all processes on)

Muon QE and Resonance events
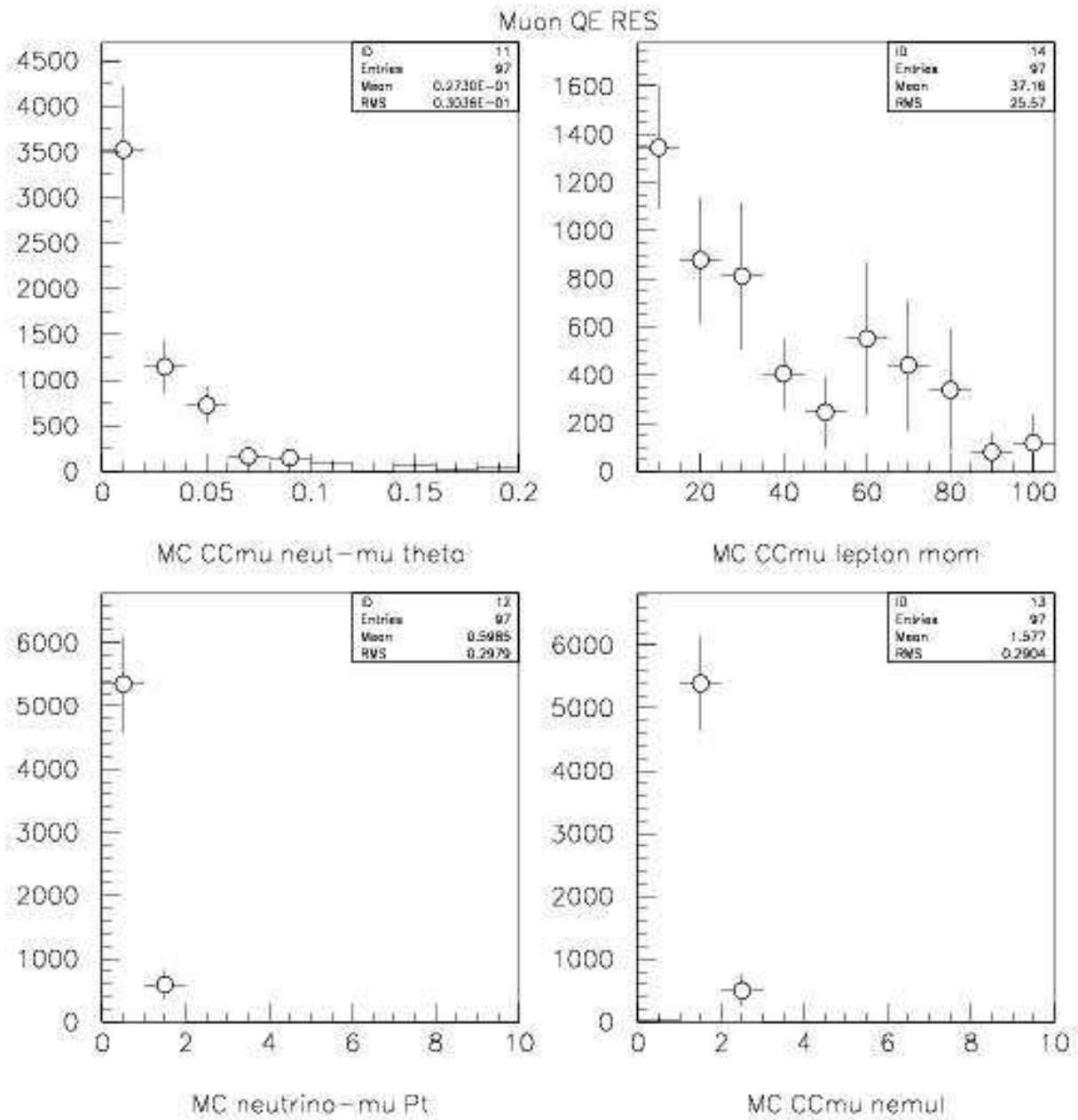
Efficiencies

	QE(e)	QE(mu)	RES(e)	RES(mu)	CCe	CCmu	CCTau	NC
Gen %	0.4%	0.9%	0.8%	1.7%	26.7%	45.2%	4.9%	19.3%
Trig Eff %	*60%*	*60%*	*55%*	*55%*	*96%*	*91%*	*NA*	*NA*
Loc Eff %	87%	83%	77%	78%	84%	85%	84%	81%
MID Tag %	0	95%	0	95%	3%	76%	15%	3%

Note: Trigger efficiency from low statistics MC run. Muon and electron QE and Resonance not separated

Data/MC Comparison

- See sfn.ps for histograms
- Trigger counter and MID panel re-alignment done in all "NEW" histograms
  - "OLD" histograms pre-date the re-alignment
- Summary
  - See slight asymmetry in data muon thx (not statistically significant)
  - CTEQ2L better match in $\theta_{\mu\nu}$ except lowest (QE/Res) bin
  - Muon momentum still too low in the data
  - P_t match still bad
  - EMCal energy now well matched with CTEQ2L (?)
- CTEQ2L now matches the data better than NEUGEN

See Data/MC difference in mu+ momentum

No differences in mu+/mu- χ^2, # DC hits – tracking OK
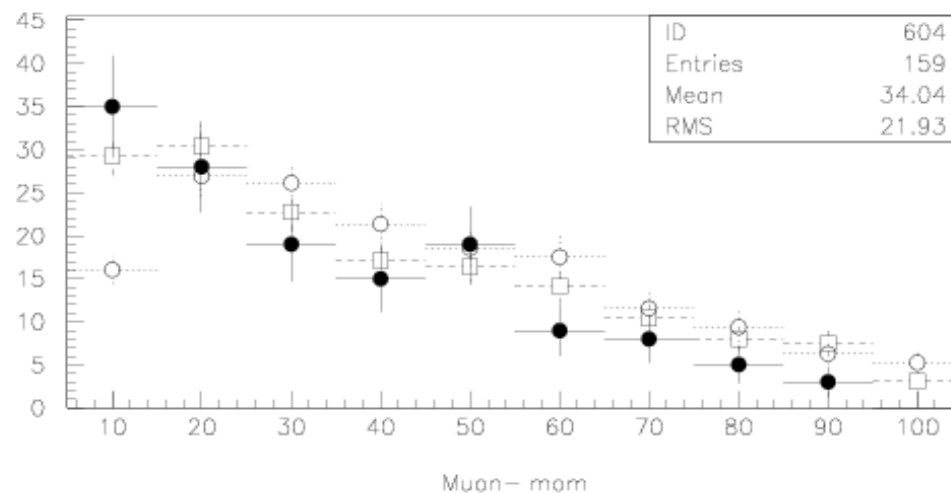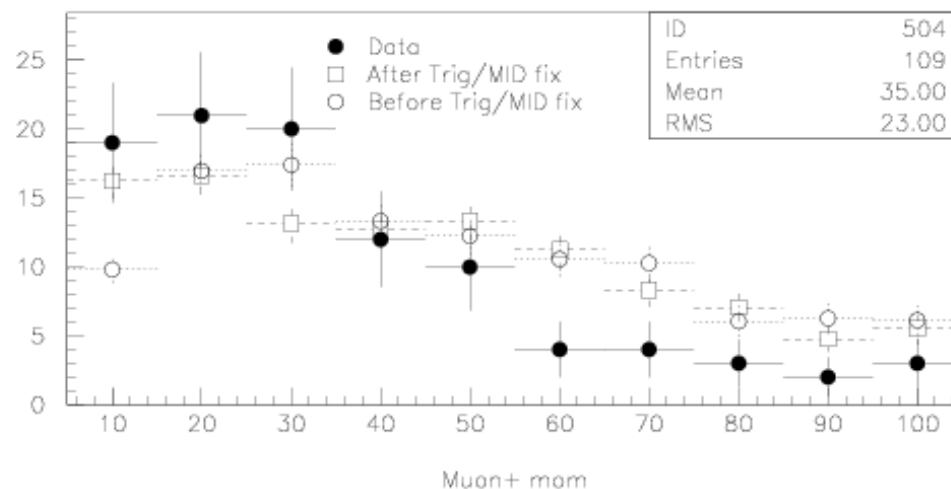
mu- ~OK
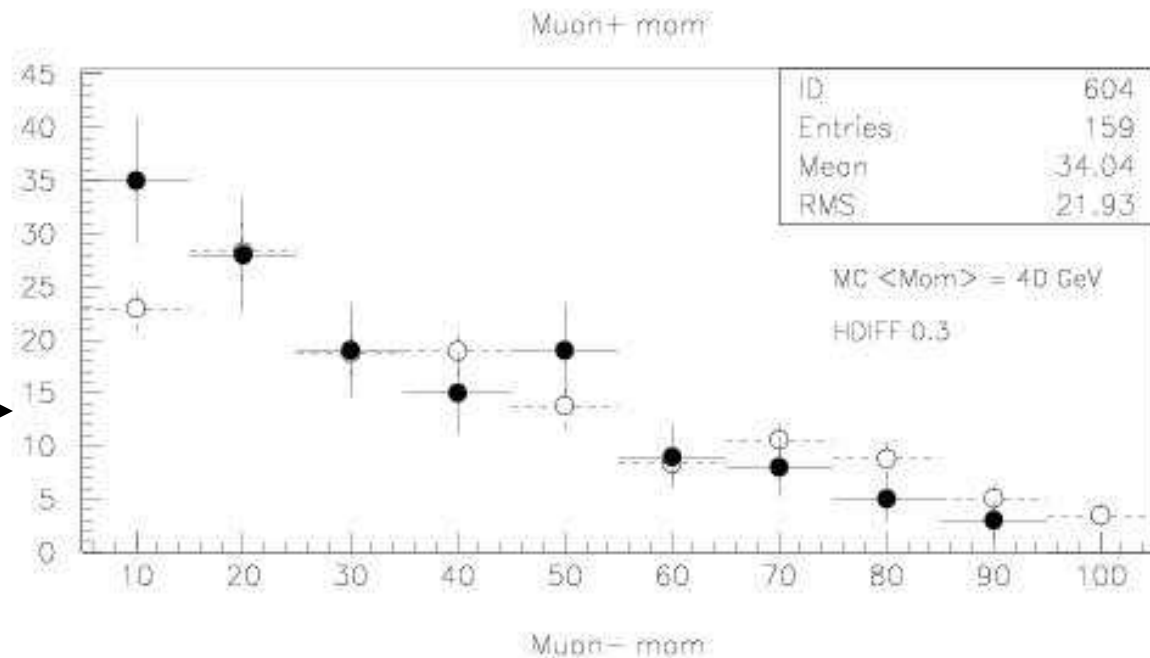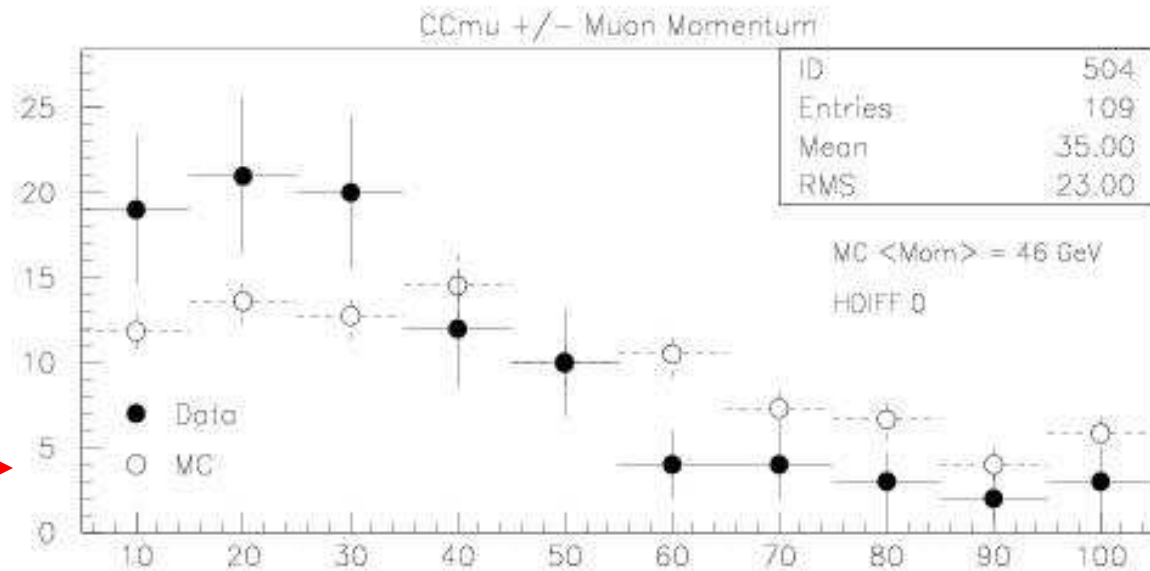
μ+/μ- Ratio

	Data	NEUGEN	Lepto Old	Lepto New
Nmu+/Nmu-	0.73	0.43	0.52	0.5
<mu+ mom>	35	46	47	45
<mu- mom>	34	40	44	40

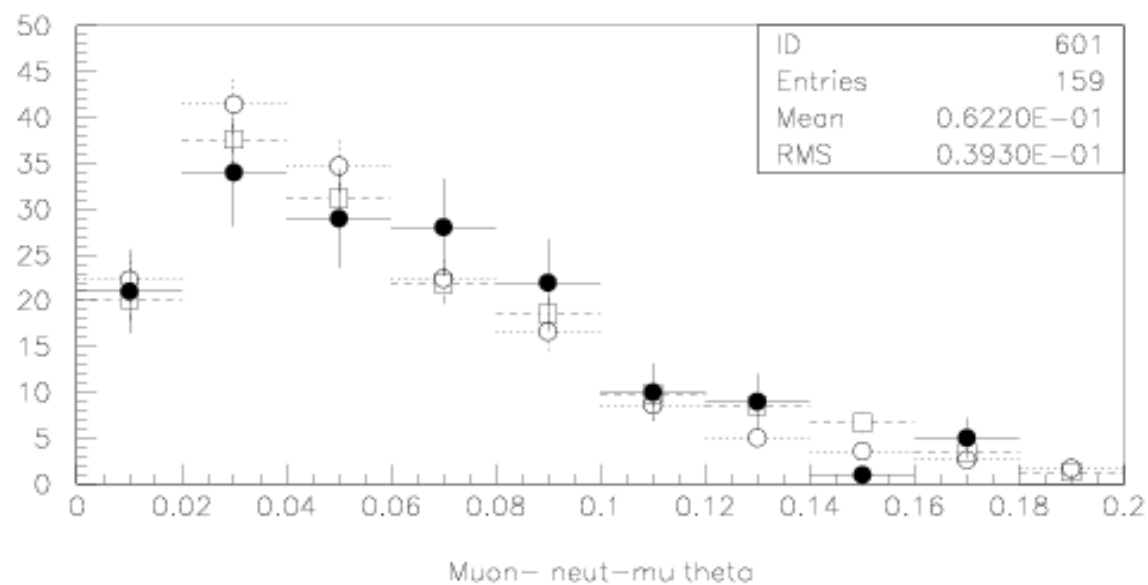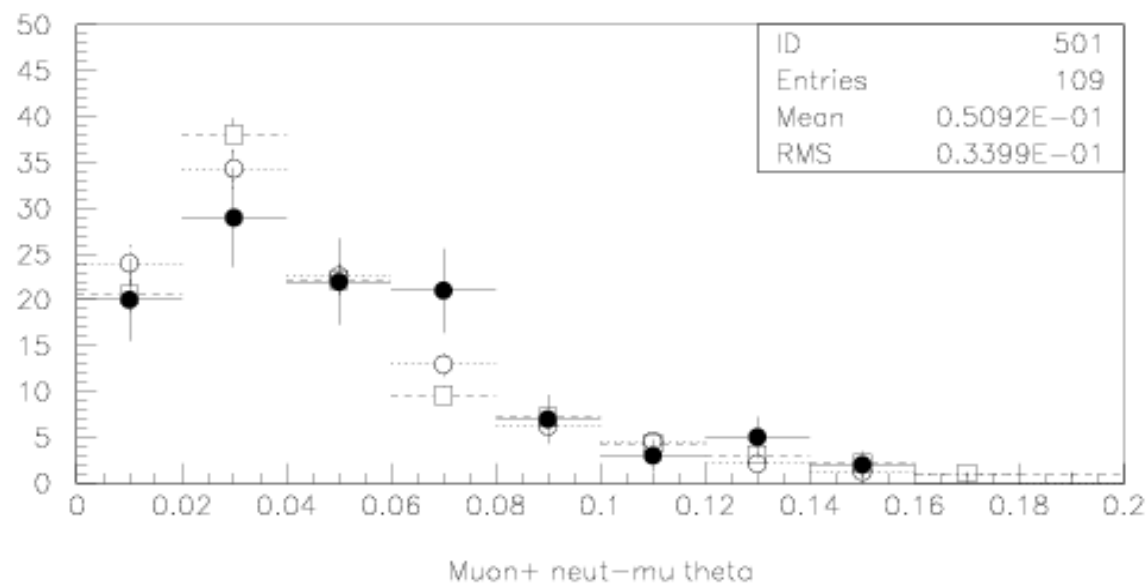*Better momentum agreement after trigger/MID alignment,*
but still lousy
Big data/MC discrepancy in ratio (P < 100 GeV)

Pick up
more low
momentum
muons after
MID fix

MC is
NEUGEN

θμν differences unchanged after Trig/MID fix

Muon+ neut-mu theta

ID	501
Entries	109
Mean	0.5092E-01
RMS	0.3399E-01

Muon- neut-mu theta

ID	601
Entries	159
Mean	0.6220E-01
RMS	0.3930E-01

Summary

- NEUGEN
  - ~3% of events are QE and resonance
  - Small angle, single track
  - Unsure of the validity of DIS model at high energy
- Significant MC/data muon momentum difference primarily in positive muons
  - Don't see this discrepancy in Patrick's thesis…
  - MID tube efficiency non-uniformity?
- Ratio of +/- muons is too high in the data
- MID alignment improves acceptance of low momentum muons
  - Lepto/CTEQ2L matches the data better than NEUGEN